

## CHAPTER 16

### GABIONS

Introduction Gabions are compartmented rectangular containers made of heavily galvanized steel woven wire. Filled with stone, the gabion becomes a large, flexible and permeable building block from which a broad range of structures may be built.

Gabions are used for the following:

- \* Erosion control
- \* Channels
- \* Earth control
- \* Shoreline protection
- \* Rockfalls

Several features make the gabions suitable for INDOT to use them as erosion control and channel liners. Those features are:

- \* Flexibility - In the presence of unstable ground and moving water, this unique feature allows a gabion structure to settle and deform without failure and loss of efficiency.
- \* Strength - The strength and flexibility of the horizontal triple-twist mesh will allow gabion structures to withstand the natural forces of flood, torrential flow and ice and earth pressures.
- \* Permeability - Gabion structures allow water collecting at the rear to drain through without the aid of an expensive drainage system.
- \* Durability - Gabions have a very high resistance to atmospheric corrosion due to the well bonded zinc coating on the wire and their ability to support vegetation growth.

Gabion structures can be subjected to various stresses and they must be able to settle, twist and conform to channel and foundation shifts and changes. At the same time, gabions must have sufficient strength to contain the weight of the rocks with which they are filled and of additional gabions that may be placed upon them. Gabions must also be able to resist the impact force of high velocity currents and soil pressure.

Introduction  
(cont'd)

This combination of factors (from the previous page) requires that the gabions have the following physical features:

- \* Hexagonal mesh pattern which under stress will deform but not break.
- \* Triple-twist which will make the mesh non-ravelling.
- \* Reinforcing wires woven into each corner which will increase the strength at the critical points and help the gabion retain its shape during and after filling.
- \* A diaphragm securely attached to the base which will prevent the shifting of the stone and at the same time reinforce the gabion.

INDOT Usage

INDOT uses gabions for the following purposes:

- \* Erosion control
- \* Revetments
- \* Channel linings

The dimensions of the gabions (baskets) used for erosion control and channel linings are normally detailed in the plans or proposal. When gabions are used for revetments they are called "revet mattresses". (The revet mattresses are only 9" in thickness.) Either type, gabions or revet mattresses, must meet certain INDOT specifications. Only the specifications for gabions will be discussed in this manual since both are similar.

The baskets, gabions, shall be made of hexagonal triple twist mesh with heavily galvanized steel wire. The maximum linear dimension of the mesh opening should not exceed 4 1/2 inches. The area of the mesh opening should not exceed 10 square inches.

Selvedged Edge

TRIPLE-TWISTED HEXAGONAL STEEL-WIRE  
MESH IS FLEXIBLE AND WILL NOT UNRAVEL

INDOT Usage  
(cont'd)

The gabions' length shall be multiples (2, 3, or 4) of the horizontal width. For example; if the basket is to be 3 foot wide then the length of any basket may be 6', 9' or 12'. Where the length of the basket exceeds 4 feet, the basket should be divided by diaphragms. The diaphragms should be of the same mesh and gauge as the basket. The diaphragms should divide the basket into cells of equal length and width.

Gabions shall be fabricated in such a manner that the sides, ends, lids, and diaphragms can be assembled at the construction site into a rectangular basket of the specified sizes. The baskets shall be of single unit construction. In other words, the base, lid, and sides shall be woven into a single unit. The ends and diaphragms shall be connected to the base section of the gabion. This connection should be such that strength and flexibility at the point of connection is at least equal to that of the mesh.

All perimeter edges of the mesh forming the gabion should be securely selvedged with wire. This wire should have a diameter of not less than 0.153". The joints formed by tying the selvedges should have at least the same strength as the body of mesh.

Lacing wire should be supplied in sufficient quantity for securely fastening all edges of the gabion and diaphragms. Lacing wire will also be used in connecting each gabion to the adjacent gabion. The lacing wire's diameter should not be less than 0.0866" (Gauge 13 1/2).

#### EDGES BEING LACED

#### Gabion Assembly

The assembly, installation, and filling of gabions are the responsibility of the contractor, but the technician should be aware of the procedure. The following are assembling instructions offered by the manufacturer:

- \* Lay a single gabion on a hard flat surface.
- \* Stretch the gabion and stamp out all kinks.
- \* Fold the front and back panels to a right angle by stepping on the base along the crease.
- \* Fold up the end panels and diaphragms. Fasten them to the front and back panels using the heavy gage wire projecting from the upper corners of each panel.

NOTE: This is the most important part of the technicians' duties, because when failures occur it is usually due to the improper lacing of edges.

- \* Securely lace all vertical edges of ends and diaphragms. Only the connecting wire supplied for this purpose should be used. No substitution of common wire is allowed. Common wire does not meet the specification requirements. The lacing procedure is as follows:
  - \*\* Cut a length of lacing wire approximately 1 1/2 times the distance to be laced. This length of wire should not exceed 5 feet.
  - \*\* Secure the wire terminal at the corner by looping and twisting.
  - \*\* Proceed lacing with single and double loops at approximately five inch intervals.
  - \*\* Securely fasten the other lacing wire terminal.

Installation     The assembled gabions are carried to the job site and placed in their proper location. Before placing the baskets, it is necessary to make the ground surface relatively smooth and even.

The following method applies to 3 foot high gabions:

- \* Gabions should be placed empty and laced for a stretch approximately 100 linear feet. For structural integrity, adjacent gabions must be laced along the perimeter of all contact surfaces.
- \* The first gabion shall be firmly anchored. Anchoring can be accomplished by partially filling the first gabion with stone.
- \* Tension should be applied to the other end with a come-a-long or other means. This achieves the proper alignment.
- \* While gabions are being stretched, inspect all corners for open "V's" which will result if corners were not properly secured. Such "V's" must be closed by relacing.

Filling            The fill material should consist of hard, durable, clean stone, 4 to 8 inches in size.

The following procedure should be taken during the filling operation:

- \* The gabions are filled in three lifts, one foot at a time.
- \* Two connecting wires are placed between each lift in each cell of all exposed faces.
- \* To protect the vertical panels from being bent during filling, rebars may be temporarily placed and laced along the upper edges. Another method is to bend a length of pliable metal and place it over the vertical panels.
- \* Gabions may be filled by almost any type of earth-handling equipment. Some manual stone adjustment during the filling is required to prevent undue voids.
- \* All exposed faces shall be hand-placed to prevent bulging and for an acceptable appearance.

Filling  
(cont'd)

- \* The last lift of stone should be level with the top of the gabion.
- \* The lids are then closed and laced to the top edges of the individual gabions and diaphragms.

Acceptance  
& Payment

Each shipment of gabions to a job site shall be accompanied by a type C certification. This certification should state that the material conforms to the requirements of the specification. The certification shall be on company letterhead and must be signed by an officer of the company having legal authority to bind the company.

Payment is normally by the cubic yard (CYS). But the proposal should be checked and conformed to.

REKET MATTRESSES

GABIONS USED FOR EARTH CONTROL  
IN AN AREA WITH LIMITED R/W.